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DEVELOPMENT OF A COMPOUND ACOUSTIC ARRAY USING DIRECTIONAL HYDR--ETC(U)
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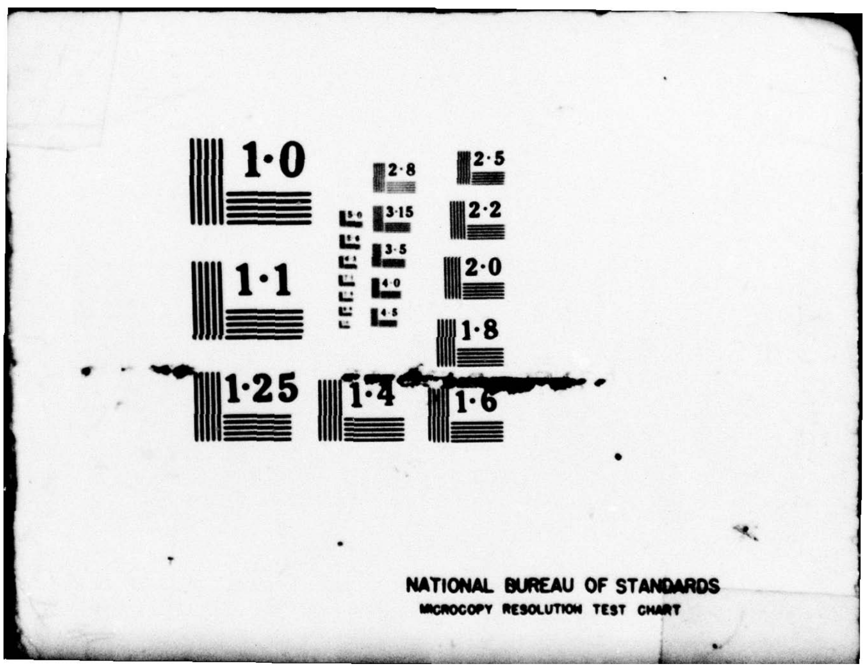
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Technical Report

# DEVELOPMENT OF A COMPOUND ACOUSTIC ARRAY USING DIRECTIONAL HYDROPHONES

IR and D Project No. 67 DIPP-2

Report No. PPD-67-E-10181

31 March 1967

MOST Project

LEVEL II

9 Technical Report

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6 DEVELOPMENT OF A

COMPOUND ACOUSTIC ARRAY

USING

DIRECTIONAL HYDROPHONES

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A six-element line array of directional hydrophones has been designed and constructed as outlined in reports PPD-66-E-10159 and 10160. ~~The array is shown in Figure 1.~~ Each hydrophone consists of a block of syntactic foam with holes machined in it to provide four different acoustic path lengths, corresponding to one-quarter, one-half, three-quarter, and one wavelength at 15 kHz. Thus, each hydrophone is equivalent to a four-element end-fire line array with element spacings of one-quarter wavelength. A ceramic disc in each hydrophone converts the acoustic signals to electrical signals which are then brought out through a length of coaxial cable.

The output of each hydrophone cable is fed to a separate amplifier, and the gain of each amplifier is adjusted to a value proportional to one of the Tchebyscheff shading coefficients calculated in report 10160. The six amplifier outputs are then summed and the output of the summing amplifier is fed to the receiver of the directivity pattern measuring system. ~~The~~ measuring system is shown in Figure 2.

The directivity pattern of the array was measured using the above measuring system and the acoustic calibration tank. A depth of five feet and a separation of six feet between the reference projector and the array were used. The settings of the amplifier gains were found to be critical. Initial directivity pattern measurements showed excessively high side lobes or wide beam widths. By carefully adjusting the gains, improvements in both side lobe levels and beam widths were achieved. Figure 3 shows a directivity pattern measured after making these adjustments.

The optimum gain settings were slightly different from those previously calculated. This may have been caused by small differences in amplitude or phase of the individual hydrophones.

A reflection from the array bracket was also found to be influencing the directivity pattern. The bracket was covered with pressure-release material, and the pattern remeasured. The result is shown in Figure 4.

The levels of the first minor lobes of this pattern are -34 db and -40 db, which are somewhat better than the -30 db obtainable by Tchebyscheff shading alone, not including individual element directivity.

Future work will include efforts to increase this minor lobe suppression to -43 db, which previous calculations show to be the theoretical limit for this array, and to decrease the width of the major lobe, which calculations also show to be narrower.

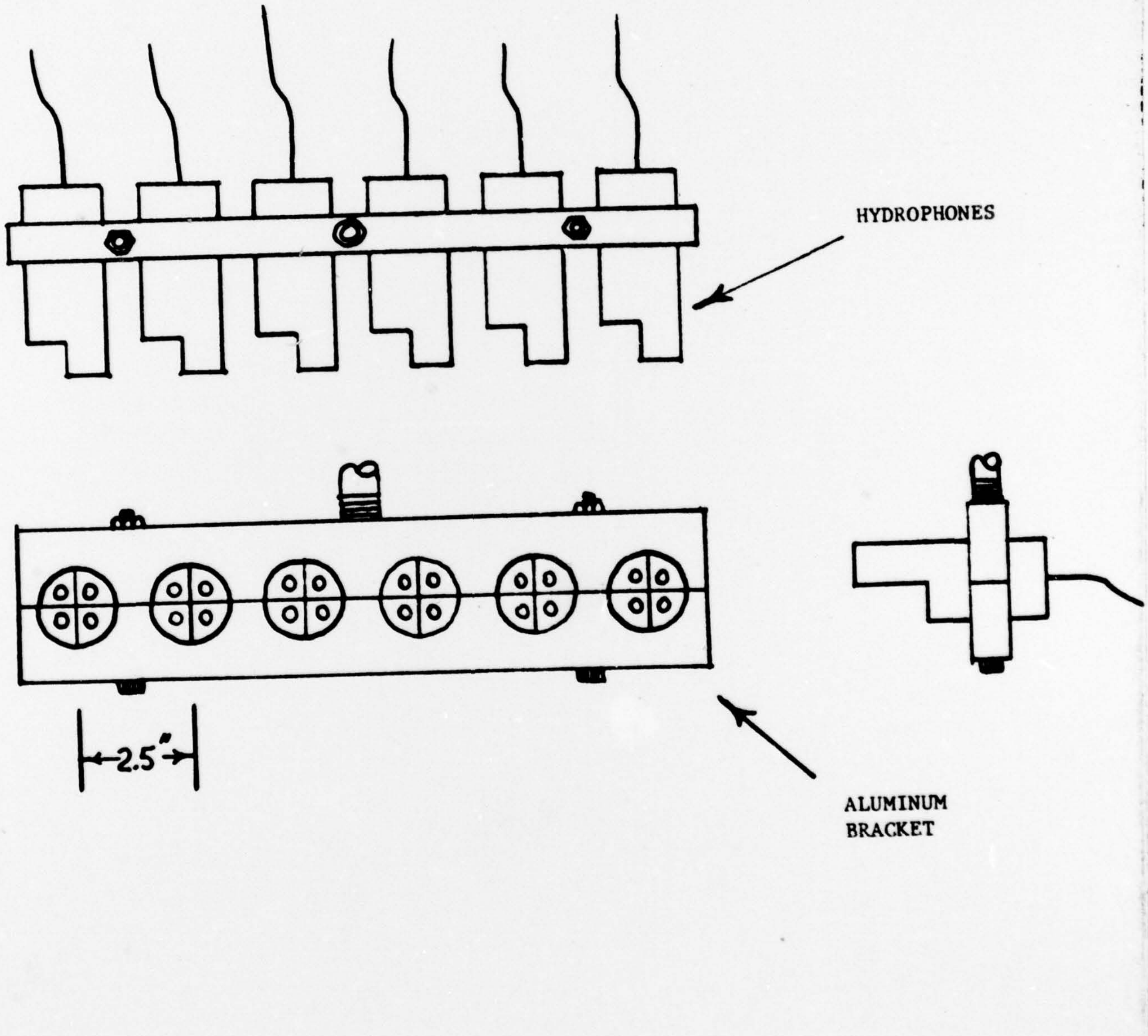



FIGURE 1

ARRAY

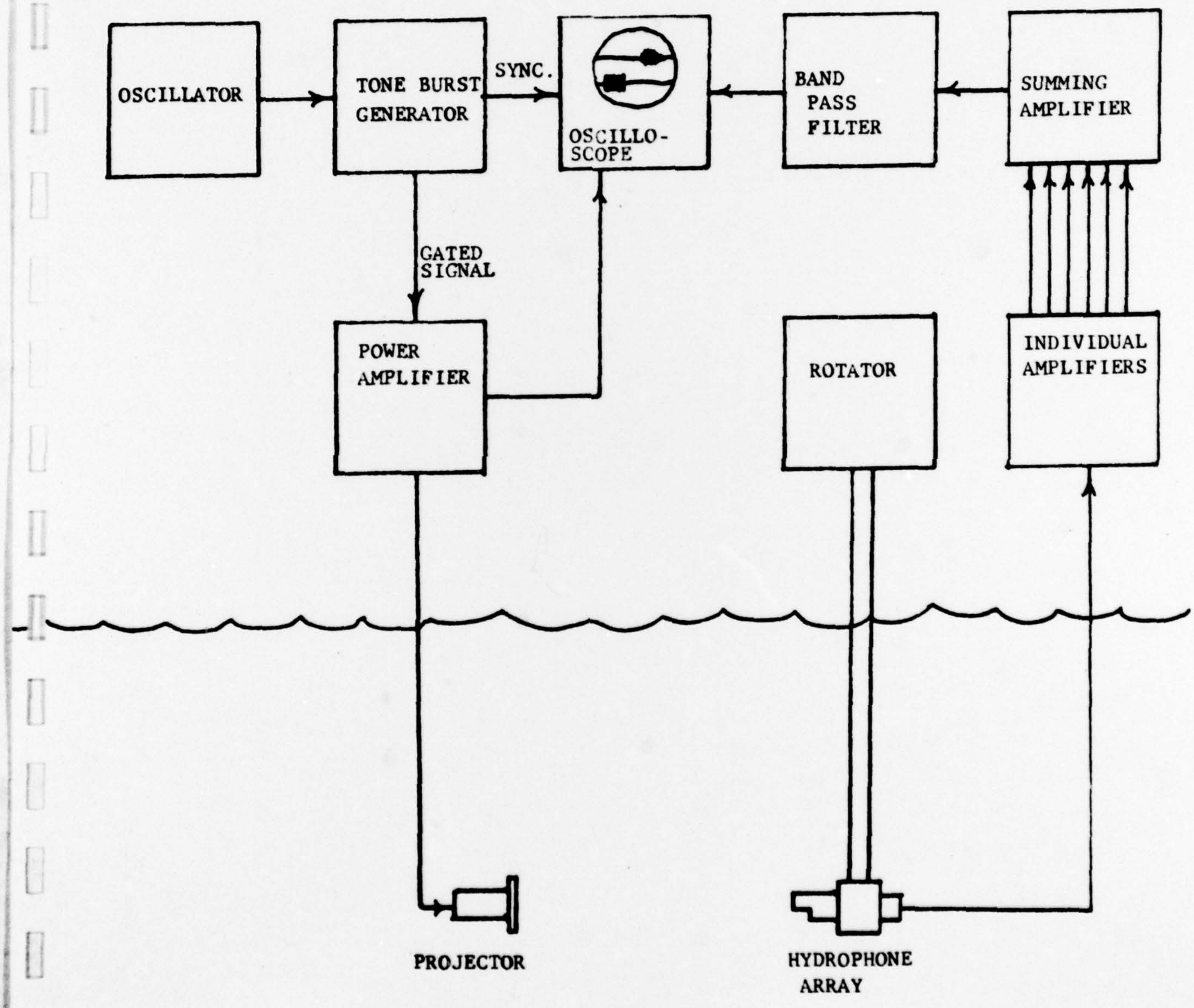
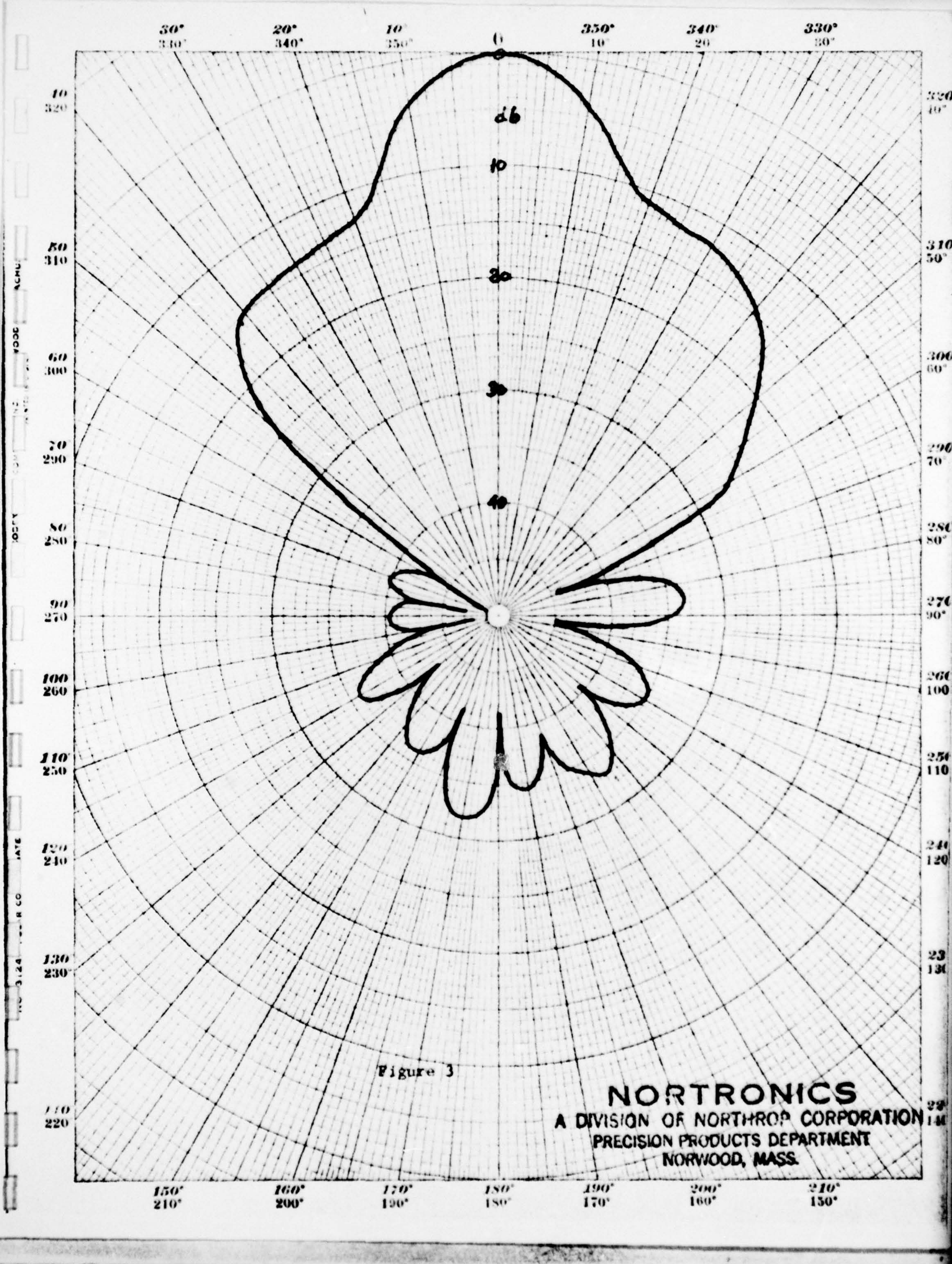



FIGURE 2.

MEASURING SYSTEM



db
10
20
30
40
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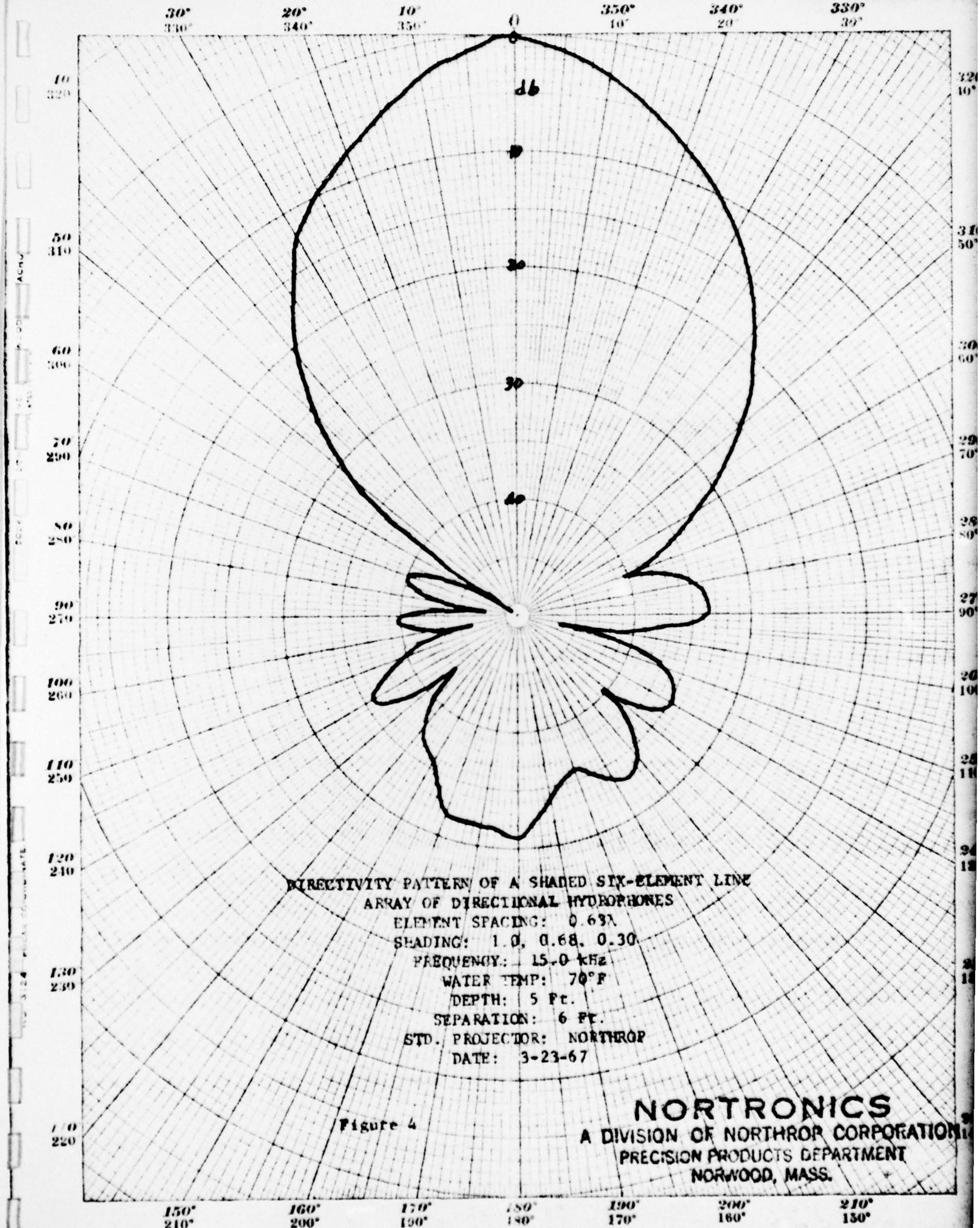
Figure 3




DIRECTIVITY PATTERN OF A SHADED SIX-ELEMENT LINE
ARRAY OF DIRECTIONAL HYDROPHONES
ELEMENT SPACING: 0.63λ
SHADING: 1.0, 0.68, 0.30
FREQUENCY: 15.0 kHz
WATER TEMP: 70°F
DEPTH: 5 Ft.
SEPARATION: 6 Ft.
STD. PROJECTOR: NORTHROP
DATE: 3-23-67

Figure 4

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